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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte YU-SHENG WANG, JUNG-CHIH TSAO, KEI-WEI CHEN,
SHIH-CHIEN CHANG, and YING-LANG WANG

Appeal 2015-001634
Application 11/416,945
Technology Center 2800

Before JEFFREY T. SMITH, N. WHITNEY WILSON, and
MONTÉ T. SQUIRE, *Administrative Patent Judges*.

SQUIRE, *Administrative Patent Judge*.

DECISION ON APPEAL¹

Appellants² appeal the Examiner's final rejection of claims 1–9, 11–15, 17, 27, 29–31, 33, and 34. 35 U.S.C. § 134(a). We have jurisdiction under 35 U.S.C. § 6(b).

¹ In this decision, we refer to the Final Office Action appealed from, mailed November 29, 2013 (“Final Act.”), the Appeal Brief dated April 28, 2014 (“App. Br.”), the Examiner’s Answer to the Appeal Brief dated September 24, 2014 (“Ans.”), and the Reply Brief dated November 24, 2014 (“Reply Br.”).

² Appellants identify Taiwan Semiconductor Manufacturing Company, LTD. as the Real Party in Interest. App. Br. 2.

We AFFIRM.

The Claimed Invention

Appellants' disclosure relates generally to the fabrication of semiconductor devices, and more particularly to a method for fabricating a barrier layer structure for a semiconductor-device electrical interconnect. Spec. ¶ 1. The method claims to produce "an improved barrier layer between the interconnect conductor and the dielectric material in which the interconnect recess is formed." Abstract. Claim 1 is illustrative of the claims on appeal and is reproduced below from the Claims Appendix to the Appeal Brief (App. Br. 22):

1. A method for fabricating a semiconductor device, the method comprising the steps of:
 - providing a substrate having a contact region;
 - depositing a dielectric layer over the substrate;
 - forming an interconnect recess in the dielectric layer;
 - depositing a first tantalum nitride (TaN) film within the interconnect recess;
 - halting the depositing the first TaN film;
 - re-sputtering the first TaN film after the halting the depositing the first TaN film;
 - depositing a second tantalum nitride (TaN) film over the first TaN film;
 - re-sputtering the second TaN film after the second TaN film has been completely deposited;
 - depositing a first tantalum (Ta) film over and in contact with the second TaN film;
 - halting the depositing the first Ta film;
 - re-sputtering the first Ta film after the halting the depositing the first Ta film;
 - depositing a second tantalum (Ta) film after the re-sputtering the first Ta film, the depositing the second Ta film being over and in contact with the first Ta film;
 - halting the depositing the second Ta film; and

re-sputtering the second Ta film after the halting the depositing the second Ta film.

The References

The Examiner relies on the following references as evidence in rejecting the claims on appeal:

Lardon et al., (hereinafter “Lardon”)	US 4,915,806	Apr. 10, 1990
Ding et al., (hereinafter “Ding”)	US 2003/0116427 A1	Jun. 26, 2003

The Rejections

On appeal, the Examiner maintains the following rejections:

1. Claims 1–9, 11–15, 17, 27, 29–31, 33, and 34 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Final Act. 2; Ans. 2.
2. Claims 1–9, 11–15, 17, 27, 29–31, 33, and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ding in view of Lardon Final Act. 3; Ans. 2.

OPINION

Rejection 1

Appellants argue claims 1–9, 11–15, 17, 27, 29–31, 33, and 34 as a group. We select claim 1 as representative of this group, and the remaining claims stand or fall with claim 1. 37 C.F.R. § 41.37(c)(1)(iv).

Claims 1 stands rejected for lack of written description under 35 U.S.C. § 112, first paragraph. Final Act. 2. In particular, the Examiner finds that adequate written descriptive support is not provided in the Specification for the “*halting* the depositing the first TaN film”; “*halting* the

depositing the first Ta film”; and “*halting* the depositing the second Ta film” limitations recited in the claim. *Id.* (quoting claim 1) (emphasis added to identify key disputed claim term).

Appellants argue that the Examiner’s rejection should be reversed because the claims fully comply with the written description requirements of 35 U.S.C. § 112, first paragraph. App. Br. 9. In particular, relying on paragraphs 37, 40, and 41 and Figure 5 of the Specification, Appellants argue that the Specification fully describes each of the claimed halting the deposition limitations because the Specification “explicitly (or, at the very least, implicitly) states that the deposition steps are performed and that the re-sputter is performed after the deposition.” *Id.* at 13. We disagree.

The test for an adequate written description “requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art . . . [and] [b]ased on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed.” *Ariad Pharmaceuticals, Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). Moreover, the “prior application itself must describe an invention, and do so in sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought.” *Lockwood v. American Airlines Inc.*, 107 F.3d 1565, 1572 (Fed. Cir. 1997).

We are not persuaded that claim 1’s “halting” limitations are adequately supported by the Specification. As the Examiner correctly points out (Ans. 3), the term “halting” is never mentioned in the Specification and none of the claimed halting steps are explicitly or implicitly described in the

Specification. The portions of the Specification Appellants identify in the Appeal Brief do not provide sufficient written descriptive support for the halting limitations. As found by the Examiner (Ans. 3), although paragraphs 34, 37, 40, 41 and Figure 5 of the Specification indicate that re-sputtering occurs after the deposition, these portions do not require or even suggest that the deposition is halted before the re-sputtering process begins or specifically halted between these steps.³ Nor do these portions preclude the broadest reasonable interpretation of the claim language, i.e., that the depositing and re-sputtering steps occur simultaneously, which, as noted by the Examiner (Ans. 3) was well known in the prior art, *see* Ding ¶¶ 85, 86, 93.

Accordingly, we affirm the Examiner's rejection of claims 1–9, 11–15, 17, 27, 29–31, 33, and 34 under 35 U.S.C. § 112, first paragraph for failing to comply with the written description requirement.

Rejection 2

Appellants argue claims 1–9, 11–15, 17, 27, 29–31, 33, and 34 as a group. We select claim 1 as representative of this group, and the remaining claims stand or fall with claim 1. 37 C.F.R. § 41.37(c)(1)(iv).

The Examiner determines that the combination of Ding and Lardon suggests all of the steps of claim 1 and would have rendered claim 1 obvious. Final Act. 3–5. The Examiner finds that Ding teaches the majority

³ The portions of the Specification relied upon by Appellants as written descriptive support also do not make clear the nature and intended scope of the term “halting,” particularly from a temporal standpoint. For example, there is no description regarding what, if any, amount of time or delay between steps would constitute “halting” for purposes of the claim.

of claim 1's limitations, but that it does not teach repeating the steps of "depositing and re-sputtering of the TaN film and the Ta film," as recited in the claim. *Id.* at 3, 4 (citing Ding ¶¶ 2, 4, 8, 82, 83, 85, 86, 92, and 93; Figs. 8A, 8B, 8C, 8D, and 9). The Examiner, however, relies on Lardon for disclosure of these limitations. *Id.* at 5. In particular, the Examiner finds that Lardon teaches "repetition of depositing (coating) and re-sputtering (resputtering) of the metal films in a microcavity." *Id.* (citing Lardon, col. 4, ll. 20–29).

Based on the above findings, the Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time of invention to combine the teachings of Ding and Lardon to arrive at Appellants' claimed method because Ding teaches "the two steps of depositing and re-sputtering of the TaN film and the Ta film in the trench" and Lardon teaches that "repeating the[se] two steps can achieve a more uniform and thick coating on the side walls of the microcavity, i.e. the trench." Final Act. 5 (citing Lardon, col. 4, ll. 20–29).

Appellants argue that that it would not have been obvious to combine Ding's and Lardon's teachings as proposed by the Examiner because the proposed modification would "render the prior art unsatisfactory for its intended purpose." App. Br. 16. In particular, Appellants argue that Ding's and Lardon's processes each have different purposes, and that because the purpose of Ding's process is "*to protect* the sidewalls and the material around the opening during . . . re-sputtering" and the purpose of Lardon's process is "*to remove* the material around hole openings," such a modification would render Ding's process unsatisfactory for its intended purpose of "providing a degree of protection." *Id.* at 17, 18. Appellants also

contends that the Examiner has failed to establish a prima facie case of obviousness because certain portions of Ding that the Examiner relies on as support are “irrelevant to the current rejection of claims 1, 11 and 27” and do not “provide additional support for the Examiner’s rejections.” *Id.* at 19.

We are not persuaded by Appellants’ arguments. Based on the record before us, we find that the Examiner’s findings regarding Ding’s and Lardon’s teachings and reasoning for why one of ordinary skill in the art would have combined these teachings to arrive at the claimed invention (Final Act. 5) are supported by a preponderance of the evidence and based on sound technical reasoning. Ding ¶¶ 2, 4, 8, 82, 83, 85, 86–88, 92, and 93; Figs. 8A, 8B, 8C, 8D, and 9; Lardon, col. 2, ll. 31–34, col. 4, ll. 6–12, 20–29. Appellants do not persuasively refute the Examiner’s factual findings in this regard or explain why the Examiner’s articulated reasoning for combining Ding’s and Lardon’s teachings lacks a rational underpinning or is otherwise reversible.

Appellants’ argument that that Ding and Lardon teach different purposes and that the Examiner’s proposed combination would render the prior art unsatisfactory for its intended purpose is unpersuasive because Appellants do not provide an adequate technical explanation or identify sufficient evidence in the record to support it. *In re De Blauwe*, 736 F.2d 699, 705 (Fed. Cir. 1984).

Moreover, we concur with Examiner’s finding (Ans. 7) that Ding and Lardon teach the same purpose for using the re-sputtering process. As the Examiner found (Ans. 5, 7), in Ding’s process the purpose of using re-sputtering is to redistribute the material of the barrier layer 351 from the bottom of the via to the sidewalls of the via 349. Ding ¶¶ 86–88, Figs. 2,

8B. As the Examiner further found (Ans. 6), Lardon also teaches this same purpose for using re-sputtering in its process. Lardon, col. 2, ll. 31–34 (disclosing that “the coating substance being deposited at first mainly on the bottom of the cavities and reaching the side walls of the cavities [occurs] only through redistribution by sputtering”); col. 4, ll. 6–12 (“By means of this so-called sputtering, the aluminum on the substrate was redistributed in a known manner, that is, a portion of the coating material, which had been sputtered from the substrate, was deposited on the side walls of the cavity[.]”).

Appellants’ contention that certain portions of Ding are irrelevant to and do not provide additional support for the Examiner’s rejections (App. Br. 19), without more, is conclusory and insufficient to establish reversible error in the Examiner’s analysis and findings in this regard. *De Blauwe*, 736 F.2d at 705.

Accordingly, we affirm the Examiner’s rejection of claims 1–9, 11–15, 17, 27, 29–31, 33, and 34 under 35 U.S.C. § 103(a) as unpatentable over the combination of Ding and Lardon.

DECISION/ORDER

The Examiner’s rejections of claims 1–9, 11–15, 17, 27, 29–31, 33, and 34 are affirmed.

It is ordered that the Examiner’s decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED